If the varietal name *alta* is accepted the only consistent course will be to recognize and name the equally distinctive low form at the opposite end of the curve—an encumbering of the literature to which I am sure any conscientious worker would object.

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## VARIATION IN THE SCULPTURE OF ACILA CASTRENSIS HINDS

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The fossil species of *Acila* are, because of the similarity of the various species, as well as because of their individual variability, more or less of a problem to the paleontologist. Dall[1] considered that, ordinarily, only one species occurs in a geologic horizon. If this were the case there would be difficulty enough in differentiating between species. Subsequent workers have, however, often listed several species from beds of a single age, only one of which might be important as a marker. It is obviously important, then, that the range of variation be known, so that a single valid species of stratigraphic importance might not be split into several of doubtful worth. It is hoped that this study may help to show the limits of variation, in the sculpture at least, of this genus.

Work on this species was suggested by Dr. H. G. Schenck of Stanford University, who is preparing a comprehensive study of the fossil and recent species of *Acila*, and to whom I am endebted for many helpful suggestions. I am also under obligation to Professor Kincaid of the University of Washington for suggestions and constructive criticism during the course of the work.

Material in the form of some three hundred and fifty-eight specimens of *Acila castrensis* was obtained from the Marine Biological Station of the University of Washington, located at Friday Harbor, Washington. As no record was kept of

[1] U. S. Geol. Sur., Prof. Paper 59, 1909, p. 102.

localities, depths, conditions of bottom, etc. (I was unable to do the collecting myself), it was impossible to attempt to formulate any relation between the different types of variation and their environment. I am inclined to believe, however, from bits of mud adhering to most of the specimens, and from what I have been told of their habitat, that the Puget Sound forms live in an almost uniform environment. They are said to be found in mud at depths of 25 to 35 fathoms.

It will be noticed from the figure that the apices of the divaricate sculpture of a specimen of *Acila* form a line of divarication or "primary bifurcation"[2] extending from the umbo to the ventral margin. Specimens of some species show other similar lines starting at the umbo or, more often, appearing toward the margin. Dr. Schenck calls the latter "secondary bifurcation". In this study the angle at which the line of primary bifurcation crosses the shell was measured, and the presence of any secondary bifurcation recorded, in order to show the variation in these characters within a single species.

The angle at which the line or lines of primary bifurcation cross the shell was measured with a celluloid protractor. Its measurement may be illustrated as follows. Suppose a right angle to be drawn, one side touching the umbo and "lunular" area of the shell, the other touching the ligamental area. A straight line connecting the apex of this angle with that part of the line of bifurcation on the most inflated portion of the shell, and extending beyond the margin, is drawn. This line and the umbo-"lunular" area line form the angle to be measured. Error due to the curvature of the shell was avoided by using that part of the line of bifurcation at the most inflated portion of the shell on all specimens. Error due to equipment or personal judgment will not exceed four degrees, and, as it is not constant, may be ignored. Variation,

[2] Schenck, H. G., according to a personal communication proposes in manuscript the terms "primary bifurcation" and "secondary bifurcation". He writes, "They are doubtless clear to you without definition". I am assuming that my usage conforms to Dr. Schenck's definitions.

throughout this study, will be referred to in terms of the right valve.

(*See Illustration on opposite page*)

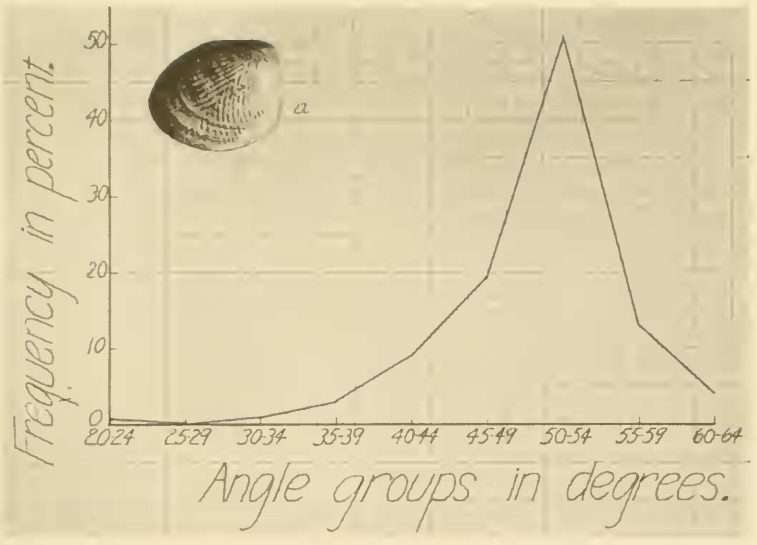
From the accompanying graph it is seen that, although there is an actual range of 38° between maximum and minimum (62° and 24°, respectively), the specimens fall into a series with 51% of its members having angles between 50° and 54°. This would indicate a normal distribution curve and that the angles on a large series are of value as a specific character.

As a test of the foregoing conclusion figures of two fossil forms, five of one and four of the other, were measured. Each species had a characteristic angle, different from that of *castrensis*. While results from so few measurements are not of any great value they suggest, at least, a real taxonomic importance for this character.

In dealing with the various lines of bifurcation certain new terms are needed. Primary and secondary lines (of bifurcation) are used as proposed by Dr. Schenck. In addition the terms *primary pattern* and *umbonal lines* (of bifurcation) are here proposed. *Primary pattern* refers to the initial sculpture on the umbo and consists of primary and umbonal lines. *Umbonal lines* are lines of bifurcation starting at the umbo and dying out within from 3 to 5 millimeters.

Observation of the shells reveals that there are six primary patterns, *with any of which may or may not occur secondary lines*. The primary patterns, with percent of the total, are as follows: (1) a single primary line, 54% (2) a single primary plus a single umbonal line, 24% (3) two primary lines, 16% ; (4) two primary lines plus a single umbonal line, 3% ; (5) a single primary line plus two umbonal lines, 2% ; (6) three primary lines, 0.6%. These differences may be due to environment or, more likely, to tendencies inherent within the genus. In either case they are not shown to have any value as specific characters.

Roughly two-thirds of the specimens examined are marked with secondary lines of bifurcation. These are from one to




At *a* a left valve of *Acila castrensis* Hinds, × about 1¼, showing divaricate sculpture.